1.0 SUMMARY OF SIGNIFICANT EVENTS

STS-101 consisted of OV-104 Atlantis (21st flight), ET-102, and BI-101 SRB's on MLP-1 and Pad 39A. Atlantis was launched at 10:11:10 UTC (6:11 a.m. local) on 19 May 2000. Landing was at 2:20 a.m. local/eastern time on 29 May 2000.

STS-101 was tanked four times, a record for the SLWT configuration. Generally speaking, the External Tank was in excellent condition for all loading and drain cycles. The only significant TPS issue involved two cracks in the +Y longeron closeout TPS since this condition was outside the NSTS-08303 guidelines. One crack was 4 inches in length by 3 inches wide by 1/8-inch wide in an inverted horseshoe shape. The second crack was horizontal, 2-inches long, and hairline in width. The two cracks were caused by thermal/mechanical induced stresses and localized defects in the thick BX-250 TPS closeout. A similar but more severe condition occurred on STS-99. That condition was approved for flight via MRB and essentially the same rationale was used for the TPS cracks on this vehicle.

One unusual debris issue was the detection of a small braided tether cable (metal) resting on the ET crossbeam the day before launch. The tether was estimated to be 5-6 inches in length, 1/16 to 1/8 inches in diameter, and a mass of 2 grams. The tether most likely fell from the upper levels of the RSS during platform securing operations prior to RSS rollback. Since the OWP's had been retracted already, no action to remove the tether was recommended based on the tether's minimal debris threat to the flight hardware. The aft location at XT-2048 was no worse than high density ice from the ET/ORB umbilicals near this location, and initial flight aerodynamic cross flow would push the tether outboard away from Orbiter tiles. As a worst case scenario with the tether moving toward tiles, there would be an insignificant aerodynamic acceleration due to the low cross-sectional frontal area resulting in little or no damage. MRB approved the condition to use as-is.

Post launch film review detected an impact from a debris object at 10:11:44.109 GMT on the Orbiter lower surface at a point that appeared to be about 8 feet forward of the right inboard elevon hinge. This event in turn caused a very visible "vaporous" streak to pass the trailing edge of the elevon.

The debris object was a 6-inch piece of ice from the ET LO2 feedline upper bellows. The ice disintegrated upon impact thereby comprising most of the material in the streak, though there may also have been some tile material as well from the damage site. After the impact, no damage site could be discerned. However, the film was grainy and individual tiles could be resolved. Therefore, the damage site was not extremely large, which would have been visible to some degree.

This streak was compared to a somewhat similar streak detected on STS-26R, which was the result of a debris impact that caused a tile damage site 18 inches long by 8 inches wide by 1.5 inches deep. However, the STS-101 streak was considerably less "dense" indicating a much smaller damage site. Shuttle Program management elected not to use the RMS for a tile survey due to lighting problems and poor resolution on such previous surveys. However, it was prudent to take some precautions anyway, so the Orbiter performed a thermal conditioning maneuver prior to re-entry to cold bias the right wing and elevon structure. This increased the temperature margin and, therefore, reduced the potential for structural damage. The detection of the debris impact and resulting damage site was not considered a Safety of Flight issue, but more of an R&R effort after landing.

Post landing inspection of Orbiter tiles showed a total of 113 hits, of which 27 had a major dimension of 1-inch or larger. The Orbiter lower surface sustained 70 total hits, of which 19 had a major dimension of 1-inch or larger. Some of these damage sites (23 hits with five larger than 1-inch) were located in the area from the nose gear to the main landing gear wheel wells on both left and right chines, which is consistent with the loss of foam from ET thrust panels. But the overall quantity and average size of the damage sites compared to previous flights were consequently reduced as a result of the pre-launch TPS venting modification. And some of the hits in this area may also be attributed to impacts from LO2 feedline bellows ice particles.

In general, the lower surface tile damage on this flight was considered to be a return to fleet averages, or "in family". Missions STS-86 through STS-103 are considered an "out of family" set due to the loss of TPS from External Tank thrust panels. With the incorporation of the successful – and full scale - TPS venting modification, missions flown after STS-103 will now be compared against the adjusted database and any data points outside the 3-sigma variation will be investigated as a new problem.

The largest lower surface tile damage site, located on the left wing immediately forward of the inboard elevon hinge, measured 8-inches long by 1.25-inches wide by 0.75-inches deep. The cause of this damage site has not been determined. However, it should be noted the damage site typically erodes during re-entry and may have initially been considerably smaller than the size listed above. Referencing the Debris Trajectory Database showed potential points of origin on the forward and mid segments of the left SRB, so it is possible a small piece of cork or BTA may have come loose in flight.

Likewise, a lower surface tile damage site on the right wing, approximately 10 feet forward of the right inboard elevon hinge, corresponded to the ice impact detected in launch films. The damage site measured 5.25-inches long by 1.5-inches wide by 0.5-inches deep, though re-entry erosion had enlarged this damage site as well. The composition of the "vaporous streak" detected in the launch films was a mixture of ice debris and damaged tile material particles.